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GUIDE FOR USE OF THE MINIMUM AIRFIELD OPERATING SURFACE MARKING SYSTEM

DEPARTMENT OF THE AIR FORCE

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AIR FORCE HANDBOOK 10-222, VOLUME 16
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Operations

GUIDE FOR USE OF THE MINIMUM AIRFIELD OPERATING SURFACE MARKING SYSTEM

OPR: HQ AFCESA/CEXR (Lt Col Wayland Patterson)
Certified by: HQ AFCESA/CEX (Colonel Bruce F. Mc Connell)
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Purpose: This handbook addresses the actions necessary for the use of the Minimum Airfield Operating Surface Marking System (MAOSMS). This includes layout of the minimum operating surface necessary for emergency launch and recovery of aircraft, placement of markers, and use of the Paint Striping machine. The MAOSMS may be used to support immediate operations from a bomb-damaged runway or for initial beddown efforts to support a bare base deployment. However, the expedient procedures and marking included in this handbook are intended for emergency recovery situations where peacetime criteria cannot be met.

Users of this handbook include the MAOSMS crewmembers -- Engineering and Structural Journeymen and augmentees required for layout, placement, and use of these systems. Installation crew leaders are assumed to have a basic knowledge of the system, its operation, and maintenance requirements. The Painting Crew is required to be knowledgeable in the operation and maintenance of the Paint Striping set. The Damage Control Center and Rapid Runway Repair (RRR) Team Chief will find additional information affecting their managing of RRR operations. This guidance is based on: AFI 32-1042; AFPAM 10-219, Vol 4; AFMAN 32-1076; AFJPAM 10-8013, Vol II;

AFCESA ETLs 94-01 and 98-5; Technical Orders 35E2-6-1, 36C35-7-1, and 35F5-3-17-1; AFQTP 3E3X1-37.1.9; FAA Advisory Circulars 150/5340-1H and 150/5345-28D; and Silver Flag (DET 1 - 823rd RHS) Minimum Airfield Operating Surface Marking System Course.

This handbook provides guidance and augments the applicable Technical Orders.

Figures.

Checklists.

Tables.

Attachments.

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INTRODUCTION

Background.

The Minimum Airfield Operating Surface Marking System (MAOSMS) was developed to support base recovery after attack efforts. It was conceived as the expedient marking system to identify the minimum operating strip (MOS). The MOS size is the smallest acceptable length and width of an operating surface that will meet an aircraft's mission configuration for takeoff and/or landing, allow minimum clearances for operation, and be ready for mission required timeframes. The MOS that Civil Engineers can provide may be larger than the minimum requirements for operations when there is little damage to the runway and most of the runway is recoverable. The MOS location is normally selected to allow *both launch and recovery* after minimal clearing of debris and safing, clearing, and removing unexploded ordinance (UXO). However, it may also be used for *immediate launch only* to support specific wartime or emergency mission circumstances.

The minimum airfield operating surface (MAOS) consists of the MOS and the access routes for aircraft from their staging location. The staging location may be a hardened shelter, revetted parking ramp, or a dispersed, camouflaged parking spot. The MAOSMS is a visual marking system that provides:

Markers and painting for the operating surface's Threshold,
Painting for the centerline,
Markers for the edges,
Painting for taxiway access lines,
Markers for Distance-to-Go (DTG) identification,
Painting to obliterate existing airfield paint markings, and
Markers for the mobile aircraft arresting system (MAAS) barrier.

When deployed, the airfield markings at an existing civilian or military airfield may be hard to see on visual approach even under normal conditions

(figure 1). After an attack, the situation is worse when airfield markings and references are obliterated or obscured by damage, debris, smoke, and haze.

Figure 1. Contingency Deployment Airfield.

The MAOSMS allows aircraft pilots to acquire the airfield-operating surface on a visual approach to the MOS on a bomb-damaged runway (figure 2). The MAOSMS provides enough markers to identify a MOS ranging from the standard MOS configuration of 50 feet wide and 5,000 feet long to a MOS as large as 150 feet wide and 10,000 feet long.

Figure 2. Bomb Damaged Airfield with MOS and MAOSMS.

RESOURCES

To lay out the markers and paint system requirements, place the markers, and paint the MAOS, two groups of personnel are required:

> **Layout/Marking:** An Engineering Journeyman (3E551) and 3 Civil Engineering augmentees and
> **Paint Striping:** A Structural Journeyman (3E351) and 1 Civil Engineering augmentee.

The Layout/Marking Crew leader, who usually functions as the MAOSMS Crew Chief, must be qualified to lay out the MOS, direct operations of the Layout/Marking Crew, and coordinate efforts through the Rapid Runway Repair (RRR) Team Chief. The augmentees should be trained on the basic layout requirements and be familiar with assembly of all markers. Personnel should be capable of handling and positioning marker components.

The Paint Striping Crew leader must be qualified to operate and maintain the paint striper equipment and operate the striper during laydown of paint and reflective beads. The Paint Striping Crew leader must also understand the basic requirements for layout of the MOS, direct the efforts of the augmentee, and coordinate efforts with the Layout/Marking Crew leader and the RRR Team Chief. The augmentee must be familiar with the basic operation of the equipment and be capable of operating the vehicle amidst base recovery operations. Personnel should be capable of handling and heavy loading of paints and glass bead supplies.

NOTE: If the Paint Striper fails, then manual application of paint with 2-gallon sprayers and rollers, and hand spreading of glass beads will be required. Additional Civil Engineering augmentees will be required.

The major equipment items associated with deployment of the system are:

Large flatbed or stakeside truck to carry markers,

MAOSMS kit,
Paint Striping Set, and
A separate pickup truck with heavy-duty suspension and adequate loading/towing capacity should be used with the Paint Striper.

NOTE: When deployed, the 2.5 ton cargo truck from the Harvest Falcon General Purpose Package is suitable, but if not available, use a truck with at least a 1.5 ton capacity and/or a flatbed trailer to carry the markers,

NOTE: Two vehicles are required to efficiently and quickly lay out and use the MAOSMS. If two vehicles are unavailable, then the truck used for placing markers may have to perform double duty to lay out the cones and markers and pull the Paint Striper. If performing double duty, then load most of the edge markers on flatbed trailers to allow the trailers to be disconnected after laying out the markers. This will not only prevent overloading the one available truck, but will allow the truck to disconnect from the trailer and hustle between priorities without having marker frames and bases fly out of the vehicle.

The components listed in Table 1 are a part of the MAOSMS and should be included in the kit. If there is a shortage of components due to loss or damage, reorder individual components per the Technical Order 35E2-6-1 parts listings.

In addition to the kit components, there are consumable items that must be available prior to attack and damage. Table 2 lists the consumables and the levels that must be maintained. These items must be ordered for use at the location; they do not come as a part of the MAOSMS deployment package. Order or reorder per the Technical Order 35E2-6-1 listings for consumables.

Table 1. Major MAOSMS Kit Components.

Component Name	Number Provided
Edge Marker Base	140
Edge Marker Top	152
Mobile Aircraft Arresting System [Arresting Gear Marker (AGM)]	4
Distance-to-Go (DTG) Marker (2 each of numbers 1 to 9)	18
Marker Crossbraced Bases and Upright Holders	22 each
Paint Striping Set	1
18-inch Traffic Cones [1]	150
200-foot Measuring Tape [1]	2
Sand Bag [1]	100
D-Handle Shovel [1]	2
NOTE: [1] These are required accessory items. Ensure that they are readily available during layout.	

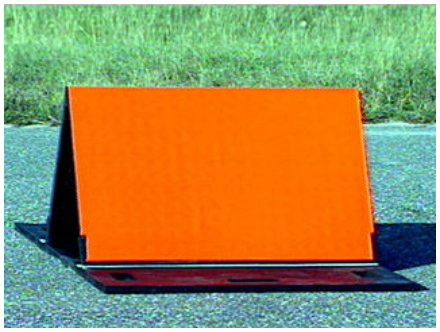
Table 2. List of Consumables.

Component Name	Amount
Retro-reflective Beads (TT-B-1325, Type I (Gradation A) or Type III)	2,000 pounds [1]
White Traffic Paint -- paint used for airfield marking	200 gallons [1] [order 4 each 55-gallon drums]
Black Traffic Paint -- paint used for obliteration of airfield and taxiway marking	200 gallons [1] [order 4 each 55-gallon drums]
Yellow Traffic Paint -- paint primarily used for taxiways	100 gallons [1] [order 2 each 55-gallon drums]
Paint Roller Frame and Handle	6 each
Paint Roller Covers	12
Replacement Sandbags	100
NOTE: [1] The amounts listed are minimum requirements for a 150- by 10,000-foot MOS.	

Major Component Descriptions. The following major components are deployed as a part of the MAOSMS.

Edge Markers. An edge marker (figure 3) consists of a heavy, hard-rubber base and an inverted "V" shaped top; the base and top are joined together with hook-and-loop fasteners. The top is made of a polystyrene board and is faced with a reflective fluorescent orange colored cover. To prevent damage to aircraft, the top is frangible. The base is 30 inches wide by 48 inches long and weighs approximately 50 pounds; the top legs of the "V" are 20 inches long and the spacing at the end of the legs is also 20 inches. When seen upon approach, the face of the sign provides a minimum of 4 square feet of viewable surface area. Be aware that some previously fielded edge markers, such as those used for tactical airlift and special operations forces, may be a cerise (i.e., cherry red) color. If present at your location and you require additional markers, then the cerise markers could be used for edge and departure end Threshold marking.

Figure 3. Typical Edge Marker.



Distance-to-Go (DTG) Markers. A DTG marker (figure 4) is a free-standing, diamond shaped, bright orange, flexible plastic retroflective sign with a single-digit numeral on one side. Each edge of the diamond shaped sign is 48 inches long; the digits are 38 inches high and are black. There is a

2-inch wide black border around the edge of the sign. The signs are unfolded and placed on vertical, crossbrace frame. See Attachment 1 for pre-attack preparations for standard folding instructions. The sign frame is mounted on a horizontal, folding crossbrace frame that has dual springs, which allows the sign to deflect if hit with aircraft turbulence. See Attachment 2 for standard frame assembly directions. The signs are held down with at least two sandbags, one located on each of two opposite sign legs. The signs are placed on the right side of the MOS and are readable on the right side. For a bi-directional MOS, the sign on the left side will not present a visible number.

NOTE: In this section and throughout this handbook, references to the left and right sides of the runway or MOS refer to the **PILOT'S LEFT and RIGHT** in the direction of the aircraft's travel. Attachment 3 provides a basic description of terms relating to the runway and MOS, which crewmembers need to be familiar with during layout and installation.

Figure 4. Typical Distance-to-Go Marker.

MAAS Markers. MAAS barrier markers (figure 5), also referred to as arresting gear markers (AGMs), are the same as DTG markers except that the 38-inch numeral is replaced with a 40-inch black, solid circle. The sign frame is the same as used by the DTG markers (see Attachments 1 and 2 for folding instructions and assembly directions). The signs are placed at the

right side of the MOS at the MAAS and are readable only on the right side. For a bi-directional MOS, the sign on the left side will not present a visible solid circle (i.e., all the pilot sees is the back of the left side sign).

Figure 5. Typical Arresting Gear Marker.

MAOS Paint Striping Set. The MAOS Paint Striping Set (figure 6), officially designated as the AF120SET, is a palletized, trailer mounted mobile airless spray system with a trailing two-wheeled gun carriage. The overall unit and trailer weighs 3,550 pounds empty and at least 5,450 pounds when loaded with paint and beads. The trailer is a 5-foot by 12-foot tandem axle trailer that weights 1,400 pounds. The unit and trailer can be towed by a pickup with pintal hook located between 18- and 24-inches high. [The truck should have a towing capacity for the unit and trailer of at least 8,000 pounds if the trailer is to be loaded with two drums of paint and solvent.] The main assembly may be demounted from the trailer and loaded into the bed of a pickup with heavy-duty suspension and a 2-ton load capacity. [**NOTE:** When loaded into the bed of a pickup truck with a lower load capacity, the AF120SET unit may not be able to carry a full load of beads and paint.]

Main specifications for the unit are:

Power: 18 horsepower diesel engine that powers a hydraulic oil pump and a single stage air compressor. The hydraulic pump is capable of operating at 2,000 PSI.

Paint Storage: two 60 gallon paint tanks.

Bead storage: a 500-pound capacity pressurized tank.
Paint Spray: a 3-gun airless spray system. Normally has a 0.035-inch orifice using a number 221-835 spray tip for wide lines; a number 221-435 spray tip may be used to provide taxi lines in lieu of manually adjusting the 221-835 spray tip.
Bead Spray: a 3-gun pressurized spray system. Normally has a 11/32-inch diameter number 45-106 nozzle, but can use smaller diameter number 45-104 and 45-105 nozzle for various densities.
Control system: Skip-line unit capable of controlling each gun.
Hand Wand: A one-gun airless spray system. The gun is mounted on a handle with two-wheel carriage, uses a 25-foot high-pressure hose, and operates at 500 to 800 PSI.

Figure 6. MAOS Paint Striping Set.

PLANNING FACTORS

The Situation. When you are deployed to a bare base or overseas location, you may face wartime bomb, mortar, artillery, rocket, and/or missile damage to the airfield (figure 7) that have caused craters, camouflets, and spalls. The minimum MOS is based on the width and length of a runway surface that will support the aircraft and mission configurations for emergency launch and recovery. The actual MOS that Civil Engineers can provide may be larger and depends on numerous factors that will influence recovery. The factors that are a part of the recovery *situation* at your location include:

Timeframe for launch or recovery,
Physical damage to the runway operating surface,
Civil Engineering resources available to perform rapid runway repair, and
Clearance requirements for UXO.

Emergency use of the MAOSMS is just that -- emergency use. The markings used to identify the MAOS (figure 8) are largely dictated by the mission and recovery situation at the location. The markings provide acceptable wartime concessions to peacetime practices and standards in order to provide rapid launch and/or recovery.

Figure 7. Bomb Damaged Airfield.

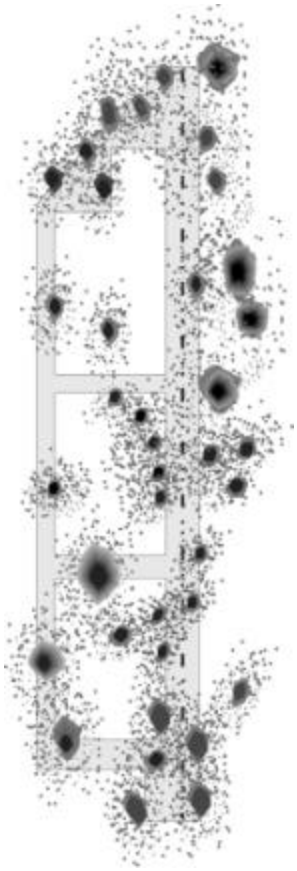
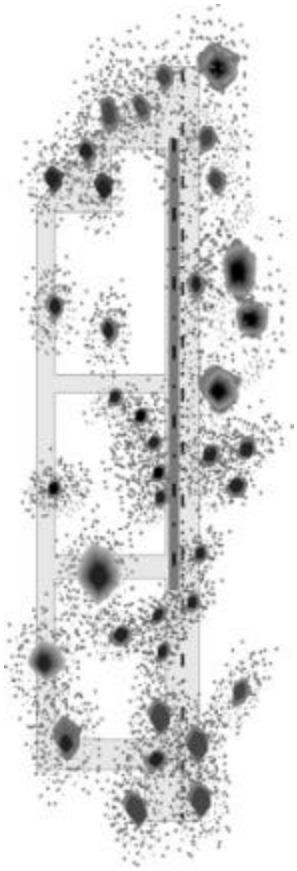


Figure 8. A MAOS Choice for a Bomb Damaged Airfield.



The MAOSMS, as well as the Emergency Airfield Lighting System (EALS), can be employed within an acceptable mission planning timeframe for most useable launch and/or recovery surfaces. Airfield marking may be one of the final steps completed in the base recovery after attack's airfield recovery

timetable for aircraft launch. This is because it depends on several other airfield and base recovery actions. The MAOSMS and EALS layouts and installations must mesh with:

Damage assessment,
UXO safing, clearing, and removal along the routes and at/along the MOS,
Large debris removal and initial sweeping and clearance of routes to the MOS and at undamaged areas of the MOS,
UXO safing, clearing, and removal throughout the airfield,
Rapid runway repair for the MOS,
Final debris removal, sweeping, and clearance on and along the MOS, and
Installation of the mobile aircraft arresting system.

The Technical Orders (TOs) for the MAOSMS and EALS provide technical requirements for the operation and deployment of these systems. They provide a set of installation steps that will apply to almost all MOS layouts and provide a common reference point for system layout, planning, training, integrating the systems, and system checkout. **However, be aware that the TOs may not provide an exact, final layout that is applicable for the installation of your MAOSMS and/or EALS.**

The emergency situation at your location may require changes to the basic TO layout configuration. **The MOS layout is acceptable** and meets launch and/or recovery criteria **when it meets the requirements of the Wing/Installation Commander.**

Be aware that if the Wing/Installation Commander's priority is for immediate launch, the initial **MOS required only for launch** of aircraft **may not be the final MOS, may not include all marking methods,** and will probably be unidirectional. The Theater mission and the Wing/Installation Commander's launch priorities and timetable can dictate one MOS for immediate launch purposes (even if the MOS is not perfectly aligned to the runway's centerline), while a fully capable, larger, bi-directional MOS is being readied

for follow-on launch and recovery. (See Attachment 3 relating to terminology used in this example and throughout the handbook.)

> **Example:**
> The Wing Commander at a bare base requires almost immediate launch of one squadron of fighter aircraft after an air attack. The 150- by 10,000-foot runway is oriented in a 18/36 direction; the 36-end is the primary operational threshold. The runway is extensively damaged with large craters on the East side of the runway about 1/3 the distance from the primary threshold. There are also two large craters along the west side of the 18-end of the runway and the 18-end West side and taxiway are both closed with numerous UXO and spall fields. Two large craters close the taxiway for the 36-end and the next intermediate taxiway is also cut in two. With limited UXO safing and sweeping, a 50- by 3,950-foot MOS for launching is available above the East-side damage. For this launch-only MOS the Wing Commander requires only edge and DTG markers and a MAAS installed 2,700 feet from the MOS threshold. While launching, EOD will continue to safe and clear UXO and the other Civil Engineering forces begin repairing the 36-end of the runway and taxiway for a 75- by 7,500-foot MOS with complete MAOS marking and EALS. The MAAS will also have to be relocated from the launch-only MOS to the final MOS.

Recovery Planning Factors. Basic airfield recovery planning factors can vary. Table 3 is a listing of some basic factors that affect airfield recovery and the layout of the MAOSMS. The table provides the basic MOS (emergency) criteria, some expected time phased upgrades that may be required during recovery, and some limitations that should be considered to allow for working around conflicts.

NOTE: Remember that if the MOS is bi-directional, there are two Thresholds that can be used for launch; these are the Operational Thresholds. However, the one that is used most often will be the primary Operational Threshold. For the purposes of this handbook, unless specifically stated

otherwise, the Threshold and departure end of a runway for a unidirectional MOS is explained the same way as the primary Operational Threshold and runway end of a bi-directional MOS.

Table 3. Basic Factors for RRR and MAOSMS Interaction.

RRR Event or System to be Installed	Emergency Criteria	Limitations or Comments
UXO Identification and Safing at MOS	**Assess, safe, and clear 100 feet on both sides off the centerline of the MOS**, its overruns, and at specifically identified areas.	Removal/clearing of some safed UXO may have to be limited to the MOS and work areas for immediate launch. There are time phased upgrades required: • Assess, safe, and clear 100 feet off of the edges of the MOS, its overruns, and at specifically identified areas. • Assess, safe, and clear 100 feet off of the edges of the runway, its overruns, and at specifically identified areas.
Debris Removal	**Push debris at least 25 feet from edge of MOS** and **ensure debris is less than 3 feet high**.	As time and mission allow, remove debris farther back from MOS and runway edges after the areas are safed and cleared of UXO. Upgrades include: • Remove additional debris at work areas such as for MAAS, EALS and its generator, and other airfield marking. • Remove debris to 75 feet from edge of MOS. • Ensure that there are no obstructions to the pilot's view.
Threshold marking	Locate 10 markers on each side of Threshold, starting 4 to 10 feet from edge of MOS. Paint an inverted "T" the full width of the MOS at the Thresholds. The "T" marking is 30 inches to 36 inches wide and matches the centerline-marking width.	Remove additional debris to about 40 feet out at ends of MOS. Ensure that there are no obstructions to the pilot's view.

RRR Event or System to be Installed	**Emergency Criteria**	**Limitations or Comments**
Centerline marking	Paint a centerline stripe that is 30 to 36 inches wide with 50-foot long stripes separated by 50-foot long gaps.	
Distance-to-Go (DTG) Markers	Locate on right side of MOS at 25 feet from edge of MOS.	Conflict may arise if the installed MAAS extends up to 25 feet from the edge of the MOS. If there is a conflict: • Install the DTG markers 35 feet from the MOS (at least 10 feet behind the MAAS). • Remove any additional debris near DTG markers to ensure that there are no obstructions to the pilot's view. NOTE: The peacetime requirement allows up to 75 feet from edge of runway.
MAAS Barrier Marker (AGM)	Locate on right side either 25 feet from the edge of the MOS (in line with the DTG markers) or 35 feet from edge of MOS (in line with and behind the MAAS). If at a DTG marker, install DTG marker at 35 feet from the edge of MOS and locate the AGM 5 feet outside the DTG marker.	Conflicts will arise for a narrow 50- to 60-foot wide MOS. Even with the shorter barrier cable, the installed MAAS can extend into the 25- to 35-foot area away from the MOS. Installing the AGM at 35 feet would still be too close to the MAAS unit, which would obstruct the pilot's view. • Install the AGM on the right side of the MOS -- at least 10 feet away from the MAAS. • Clear any additional debris from around the MAAS and AGM to ensure that there are no obstructions to the pilot's view. **NOTE:** The peacetime requirement allows up to 75 feet from edge of runway. It also calls for locating the DTG marker 5 feet outside of the AGM sign (per AFM 32-1076).
Edge Markers	Markers are located on each side of MOS and are installed • at equal distances from the MOS,	When the MOS is located along the edge of the runway and there are few visual contrasts to delineate the edge of the runway from the shoulder, then set the markers as close as possible to the edge of

RRR Event or System to be Installed	Emergency Criteria	Limitations or Comments
	• between 4 feet and 10 feet from the edge of the MOS, and • at 200-foot intervals.	the MOS (i.e., 4 feet).
Taxiway marking	Paint a 6-inch wide stripe that is 5 feet from the taxiway holding line and leads from the taxiway holding line to 3 feet from the MOS centerline. Taxiway lines are used at MOS and around other curves near damaged sections of the taxiways and apron. Markers not typically employed.	If there are straight sections of the taxiway that are not readily visible due to lack of contrast, the 6-inch centerline stripe should also be painted through these areas. MAOSMS markers may have to be placed along taxiways if the MOS must be used to support emergency cargo airlift operations. • Markers should be placed 10 feet to 15 feet away from the edge of the taxiway at up to a 120-foot spacing for turns and up to a 220-foot spacing for straight sections. • The 10-to 15-foot distance may have to be increased if the aircraft's outboard engines overhang the markers and/or the outboard engines can not be operated at idle power while taxiing.

While not a specific part of the MAOSMS layout effort, if an EALS system is to be installed at the same time as or in conjunction with the MAOSMS, then the layout of the EALS system should also be accomplished as a part of the MAOSMS layout. In this case, additional layout requirements are necessary for the:

Runway approach zone lighting,
Precision Approach Path Indicator (PAPI) systems,
Taxiway lighting, and
EALS generators.

As a minimum during initial MOS layout, set traffic cones at the correct positions for the approach zone lighting and PAPI units. Since additional work may be required for UXO and debris clearing to allow the EALS system to be installed with the MAOSMS, check to see that the airfield base recovery timetable reflects integration of the MAOSMS and EALS.

Criteria are provided for MAOSMS layout and MOS planning in Checklist 1. The criteria provide a quick reference for actions (and questions to ask) to determine the layout of the system. The checklist is also applicable for planning rapid runway repair efforts along with MAOS marking. The checklist provides information for the MAOSMS Crew Chief to consider avoiding conflicts during layout and installation of the MAOSMS and EALS. The Damage Control Center (DCC) and RRR Team Chief can use portions of this checklist to track information required for layout.

Checklist 1. MAOSMS Layout and MOS Planning.

Application	Required Action
____ 1. MOS is required in lieu of full runway	____1) Determine if the standard marking criteria are required for the MOS. ____2) Determine if EALS layout will be accomplished with MAOSMS. ____3) Determine if EALS will be installed prior to placing MAOSMS markers.
____ 2. MOS	____1) What is the width? ____2) What is the length? ____3) Is the MOS unidirectional or bi-directional? ____4) Which end is the (primary) Operational Threshold?
____ 3. MAAS	____1) Determine the number of MAAS barriers to be installed and the installation location(s). [**NOTE:** Initial Harvest Falcon deployment packages usually have one MAAS barrier. A second would have to be ordered to allow bi-directional operation.] ____2) Determine length of cable to be used with MAAS. ____3) Determine distance the MAAS units will be set back from runway. ____4) Determine if there are any conflicts with other locations (DTG markers, edge markers and lights, PAPI units, etc.).
____ 4. UXO	____1) If there are UXO in the work area, obtain the expected time to clear UXO from runway and 100 feet from centerline. ____2) Ensure that EOD is aware of which end of the MOS will be the Threshold (for early assessing and safing). ____3) If layout requires work at both ends of the MOS let the Survival Recovery Center (SRC) know that EOD may have to assess and safe both MOS Threshold and departure ends to allow initial MOS layout.
____ 5. Threshold marking	____1) Will the inverted "T" and centerline be required initially if the initial MOS is for launch only? ____2) Will the Threshold markers be required initially if the initial MOS is for launch only? ____3) Ensure that the "T" width matches the centerline stripe width.
____ 6. Centerline	____1) Based on the size of MOS, local conditions, available paint/bead supply, and the set-up of the Paint Striper, determine the width of the centerline stripe (i.e., 30 inches or 36 inches wide). ____2) Are there any crater repairs located within the MOS?

Application	Required Action
____ 7. PAPI Light Location	____1) Check with the SRC to determine if the normal 950-foot distance from the Threshold should be used or adjusted for changes in elevation between the PAPI, the runway reference point (RRP), and the RRP and the Threshold elevation? [**NOTE:** the RRP is a point on the runway centerline adjacent to the PAPI units and is located where the visual glide path intersects the MOS.] ____2) If the sited area has major variations in height, get with the RRR Team Chief to determine if leveling is possible or the SRC will have to adjust the PAPI location? ____3) Are there any landing requirements or new obstructions that require a change in location or adjustment of the glide path approach angles?
____ 8. Edge Markers	____1) Establish a standard edge marker setback distance from the edge of the MOS. This is between 4 and 10 feet from the edge of the MOS. NOTE: EALS edge lights will be installed 1 foot inside of the edge markers. ____2) Ensure that the initial edge markers at the Threshold are aligned to allow 10 markers on the left and right sides of the MOS.
____ 9. Distance-to-Go (DTG) Markers	____1) Determine the available distance setting back the DTG markers. Consider UXO clearance, debris clearance, MOS width, and MAAS setback requirements. ____2) Check for conflicts with barrier marker (AGM). ____3) Determine spacing for the MOS that is not an even increment of 1,000.
____ 10. Arresting Gear Marker (AGM)	____1) Ensure that UXO and debris are cleared to allow installation for MAAS setback. ____2) Determine required setback for marker based on setback of MAAS, DTG markers, and ability to provide unobstructed pilot's view of AGM.
____ 11. Taxi line	____1) Obtain through the SRC the minimum taxiway turning radius acceptable for the mission aircraft. [NOTE: If specific data is not provided by SRC, most fighter aircraft can use a 50-foot radius at low speed. Emergency shortfield operations of cargo aircraft (C-17 and C-130) can use a 90-foot radius.] ____2) Determine the beginning and end (i.e., lead-in and lead-out) locations for the taxiway stripe arcs at the MOS. ____3) Check for conflicts with edge clearance.
____ 12. Obliteration	____1) Determine if any airfield marking must be obliterated if the MOS is for immediate launch. ____2) Determine what airfield marking will have to be

Application	Required Action
	obliterated for normal MOS operations (i.e., launch and recovery).
____ 13. Reporting to RRR Team Chief/SRC	____1) Are there conflicts with (Table 3) MAOSMS Emergency Installation Criteria? ____2) Are there any UXO and debris clearance problems and setback conflicts that can not be resolved by the RRR Team Chief and EOD? ____3) Are there leveling problems or conflicts in siting the MAAS and PAPI? ____4) Must the marking criteria be changed to allow workarounds for the situation? ____5) Contact SRC for obtaining the Wing/Installation Commander's approval of marking workarounds.

PAPI Location Planning Factors. As listed in the checklist, the PAPI units may have to be sited at a different location other than 950 feet from the end of the Threshold. This may be required if there is:

A great enough difference in the height of the PAPI units from the runway reference point (RRP) for approach alignment,

An approach obstruction, or

A runway slope from the Threshold to the RRP.

For MOS use under emergency conditions, the units should be within 1 foot of the elevation of the RRP to allow use of the 950-foot distance and **must be** within 1 foot of elevation between the two units.

On existing airfields, normally the glide path approach angle for the PAPIs will not be affected by approach obstructions. Most airfields will have already been sited based on obstruction criteria; placing a MOS inside the existing runway surface will also avoid obstructions unless the attack has created new obstacles from thrown debris.

The normal setup is to place the cone markers for the PAPI units at the 950-foot position down from the Threshold. It is very important, especially for emergency recovery of aircraft on a short MOS, to provide enough stopping distance on a short MOS. Adequate stopping distances are affected by the weather and pavement condition, especially if the weather conditions are wet

and there is no porous friction course. **For short MOS operations where the stopping distance is a major consideration, there are at least four approaches for providing more stopping distance by adjusting the PAPI placement and/or installation.**

Exact PAPI to Threshold Distance. The first approach is to use the exact PAPI to Threshold distance if that distance is less than 950 feet. Figure 9 provides a graphic range of values for installing the PAPI from the Threshold based the PAPI installation formula in the Emergency Airfield Lighting System handbook AFH 10-222 Volume 7. The formula procedure provides the exact displacement from Threshold distance for the units when the PAPI is level with or up to 10 feet lower than the centerline of the MOS (adjacent to the PAPI). It provides distances from the Threshold to the PAPI based on glide slope angles ranging from 2.5 to 4.0 degrees for the ranges of height variation of 0 to 10 feet. It also is good for fighter aircraft and cargo aircraft, but only for cargo aircraft capable and approved for shortfield landings.

Figure 9. PAPI Distances from the Threshold.

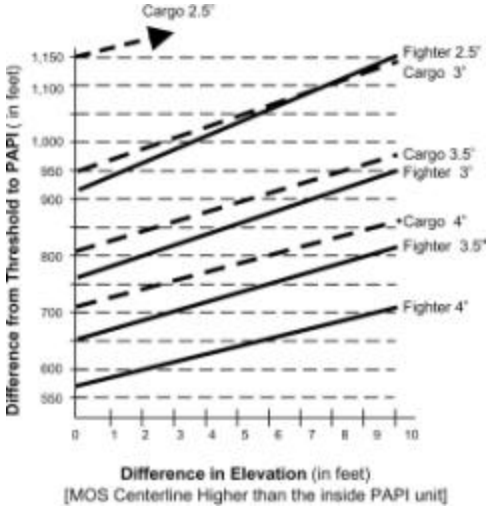


Figure 9 shows that fighter aircraft can normally land with a PAPI distance to threshold less than the standard 950-foot distance. This is the case even with large differences in elevation between the PAPI and the MOS. An exception to this is for fighter aircraft if the PAPI is adjusted for a 2.5-degree glide path approach angle. Then the 950-foot distance has to be increased for differences in height of more than 2 feet.

PAPI Mounting Height. The second approach is to raise the elevation of the PAPI units to the same level as the MOS centerline to avoid increasing the distance from the Threshold or changing the angle of the PAPIs from the standard 3.0 degrees. The Layout/Marking Crew leader must identify the required amount of elevation to raise the PAPI.

PAPI Angle. The third approach is to increase the glide path approach angle above 3.0 degrees. Increasing the angle above 3.0 degrees is feasible for fighter aircraft and shortfield-capable cargo aircraft in order to provide additional runout area for stopping.

Combination. The fourth approach is to use a combination of the above to decrease the Threshold distance or to allow moving the PAPI to a different location. Relocating the PAPI to another distance from the Threshold may be considered for numerous reasons. If it is necessary to install the MAAS at a certain location on the runway, then the PAPI could conflict with the MAAS location. The PAPI may also have to be resited if it is too close to the taxiway, major damage, or other obstruction.

The Survival Recovery Center (SRC) and DCC should consider the above **during the overall siting** of the MAOS. If it only becomes evident in the field that there may be a conflict with siting the PAPI and/or the MAAS, then contact the RRR Team Chief and the DCC/SRC to consider relocating the units based on the above approaches. Relocation and adjustment of the PAPI can only be approved through the SRC. Also contact the RRR Team Chief to address leveling the area at the PAPIs if there are variations in height.

Even when there are no extreme variations in height along the runway and MOS, you may have to consider leveling the area where the PAPI units are located if:

There is a variation in elevations of more than 3 or 4 feet between the inside PAPI unit and the MOS **and**

Smoke and damage at the runway or approach zones may obscure normal visual cues near the end of the MOS.

When the above conditions exist, consider grading the areas between the MOS and the PAPI units to bring the units closer to the elevation of the MOS centerline. This will provide a flatter reference plane for pilots and helps eliminate disorientation. While the two PAPI units can have a difference in elevation by as much as 12 inches, when normal visual cues are obscured near the end of the MOS, consider leveling the area between the two units. Bringing the units to the same elevation (± 1 inch) ensures that the units can be more precisely aimed for both direction and altitude at the 4-mile distance.

IMPORTANT: The PAPI units contained within the EALS are a two box L-881 system. They are a less precise system than the standard four box L-880 PAPI system. The L-881 equipment specification for the EALS PAPI system recommends that the inside and outside PAPI units **always be separated by a distance of 20 feet between units**. **This separation is the distance between the outside edge of the inside PAPI unit and the inside edge of the outside PAPI unit.** The 20-foot separation allows the EALS PAPI to be more effectively aimed for the required 4-mile aiming radius.

Some airfields that slope up or down from the Threshold may already have established peacetime adjustments for the Threshold and glide path approach slope. If so, then these peacetime adjustments for approach lighting should be considered for use with the MOS if the MOS falls within the same runway elevation slopes. For more details on adjusting the PAPI units based on runway to Threshold slopes, see the Emergency Airfield Lighting System (EALS) handbook, AFH 10-222, Volume 7.

BASIC CONFIGURATION LAYOUT

The basic configuration layout of the MOS and access taxiway(s) is the initial effort to place the MAOSMS traffic cones or other expedient marking devices (such as marking paint or lumber crayons (Keel)). The initial marking is to establish the key points for: the MOS and taxiway(s), installation of MOS and taxiway markers, painting, and location of the PAPI and approach lights. The first priority is to establish the location for the MOS centerline and the operational Thresholds.

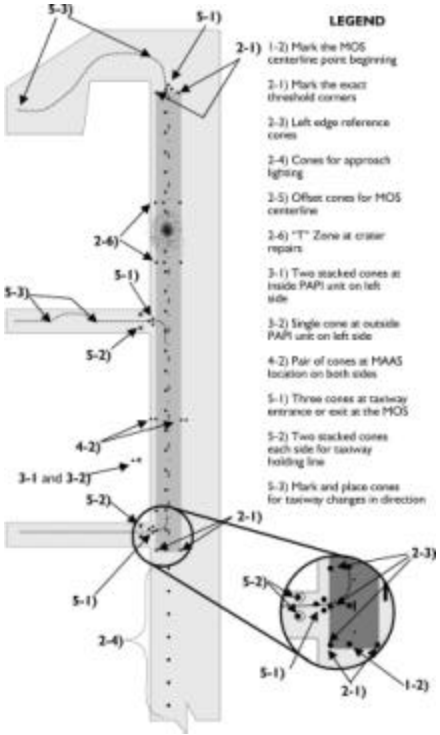
Based on current threats, a MOS supporting both launch and recovery can be located such that it is parallel to the runway centerline. This will allow the runway centerline to be used as the reference point for establishing the MOS centerline. The MOS boundaries become an important reference for all RRR work within and around the edge of the MOS. If the runway does not have an established pavement reference marking system (PRMS), consider installing one as a pre-attack effort to expedite MAOSMS installation and use.

A PRMS should have a zero point established for each pavement feature (i.e., runway, taxiway). For the runway, the Threshold at one end becomes the zero point. Paint marking on the pavement edges is set up at regular 50- and 100-foot intervals. Raised vertical markers are placed every 100 feet and are located away from the edges of the runway. Do not locate the raised markers too close to the edge of the runway, as the markers could then interfere with recovery efforts and the deployment of the MAOSMS and EALS. A distance of 75 to 100 feet from the edge of the runway should be sufficient for most threats.

Checklist 2 provides a set of suggested quick check-off procedures for key processes and actions for configuring the basic layout. It can be used as a familiarization guide for installing the MOS. It can also be used by the DCC and the MAOSMS and RRR Team Chiefs to track progress of the MAOSMS efforts. Key identification points on figure 10 are shown as related to the

appropriate Checklist 2 designation. Figure 10 depicts layout requirements for a unidirectional MOS with a taxiway at the operational and departure ends of the MOS. **NOTE**: If this was a bi-directional MOS, the MOS would require a second set of approach lights from the other end and require changing the taxiway layout based on the runway lights.

Figure 10. Example Unidirectional Configuration Layout.



Checklist 2. Basic Configuration Layout.

Procedure	Actions
____ 1. Establish MOS frame of reference.	____1) Using the runway centerline and (if available) the distances from a runway reference system, identify the location for the MOS centerline point beginning. [If the MOS is used as a temporary, immediate-launch-only MOS, it may be have to be located such that it is not exactly parallel to the runway centerline. Then the MOS centerline end point and departure end corners will also have to be determined initially.] ____2) Mark the beginning of the MOS exact centerline point.
____ 2. Layout the Centerline	____1) Mark the exact points for the Threshold corners. ____2) Accomplish the initial three-cone alignment. ____3) Place a three-cone alignment on the left edge of MOS. ____4) Lay out and place cones for approach lighting. ____5) Layout the MOS centerline. ____6) For any areas on the MOS that requires a crater repair, mark a work area with a "T" zone.
____ 3. PAPI Location	____1) Site the inside PAPI unit using two stacked cones on the left side of the MOS 50 feet from the edge of the MOS. ____2) Site the outside PAPI unit by placing a single cone 20 feet outboard of the first cone.
____ 4. MAAS Location	____1) Use the coordinates from the SRC to determine the location(s) for the MAAS. ____2) Place a pair of cones at both edges of the MOS where the MAAS is to be located.
____ 5. Taxiway Location	____1) Mark the entrance to the taxiway at the MOS with three traffic cones next to each other in a triangle. ____2) Mark the position for the taxi holding line with two stacked cones on each side of the taxiway. ____3) Mark out and place cones for access taxiway changes in direction.

Taxiway Paint Striping Layout. The Marking/Layout Crew establishes locations for all taxiway intersections with the MOS and for taxiway stripes that have changes in direction around damaged sections of a taxiway. The Paint Striping Crew normally performs the detailed layout for taxi line striping. The following information is provided for the Paint Striping Crew.

Just as the example layout in figure 10 depicted, taxiway locations and designs may present various situations that require additional layout efforts. Figure 11 depicts several typical taxi line stripe layouts. The stripe begins at a point 3 feet to the near side of the MOS centerline and extends to 5 feet from the taxiway holding line. The curved portion of the stripe should be made with a smooth, constant radius arc that starts on the MOS. The arc:

Must be at least as large as the **minimum taxi turning radius** (**R_m**) for the operational aircraft in its mission configuration,

Must ensure that the **minimum taxiway width** (provided by the SRC) can be maintained without running off the edge of the full strength pavement or repaired surface,

Must have a **minimum radius** that is at least half the minimum taxiway width, and

Should end prior to the taxiway holding line.

The start end of the curve on the MOS is extended parallel in a straight line for a distance of 200 feet beside the MOS centerline.

Based on the radii of the taxiway arcs, the Paint Striping Crew can choose to use the Hand Wand to paint the taxiway stripe or use the Paint Striper. If the radius of a turn is too tight for the Paint Striper, then the Paint Striping Crew may use marker paint or Keel when laying out the curve. The Paint Striping Crew would mark:

The exact locations for the start and end of the arc(s),
Intermediate points on the arc,
The 200-foot lead-in line, and
The taxiway centerline stripe from the arc to a point 5 feet short of the holding line.

If cones Hand Wand will be used, then offset the cones about 9 inches to the left of the exact position when using the Hand Wand. If the Paint Striper can

be used for painting the stripes, then offset the marks or cones to the left based on the offset distance for the gun. This offset distance can be adjusted based on the:

Radius of the arc,
Setup of the Paint Striper,
Setup of the tow vehicle, or
Setup of the vehicle carrying the (demounted) Paint Striping unit.

In some cases a high-speed taxiway, which is a taxiway that enters a runway at an acute angle, may have to be used as a MAOS emergency taxiway. A MOS with an acute angle taxiway is shown in the bottom portion of figure 11. For this type of taxiway, at least the minimum taxi turning radius must be provided at the entrance of the taxiway that requires the reversing type turn. The taxi turning radius for an aircraft travelling in the other direction will be longer in order to provide a smooth arc that intersects at the same position on the taxiway (figure 12) as the minimum taxi turning arc. As shown in figure 13 when laying out the arcs, the distance CB is normally laid out about equal to distance AB. CB and AB are the distances from the two points at the start of the curve on the MOS offset (Points C and A) to a point at the imaginary intersection of the emergency taxiway centerline with the MOS centerline offset (Point B).

During emergency use, you will probably not be able to set up a long taxiway curve that meets design standards. When the acute angle is less than 45 degrees, the radius necessary to create a smooth curve ($\mathbf{R}_{\mathbf{smooth}}$), which meets peacetime taxiway criteria, would create an arc that would be too long for the MOS.

> **Example:** To meet peacetime (FAA) criteria, a 30-degree taxiway for taxiway entrance, would have a radius ($\mathbf{R}_{\mathbf{smooth}}$) of 800 feet and the distance CB would be more than 700 feet. It is not possible to quickly lay out this large a radius curve under emergency conditions, especially when UXO are present.

Figure 11. Typical Layouts for Taxiway Lead-in/Lead-out Stripe.

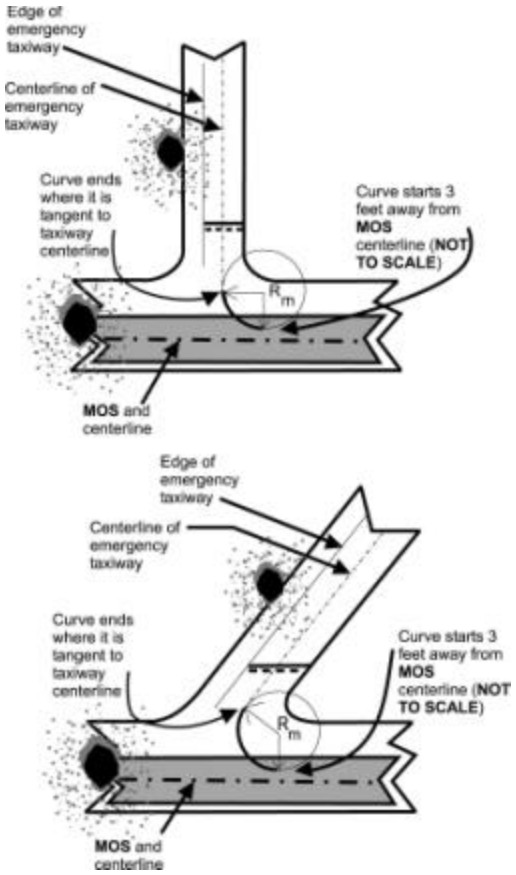


Figure 12. Typical Taxiway Stripes for an Acute Angle Taxiway.

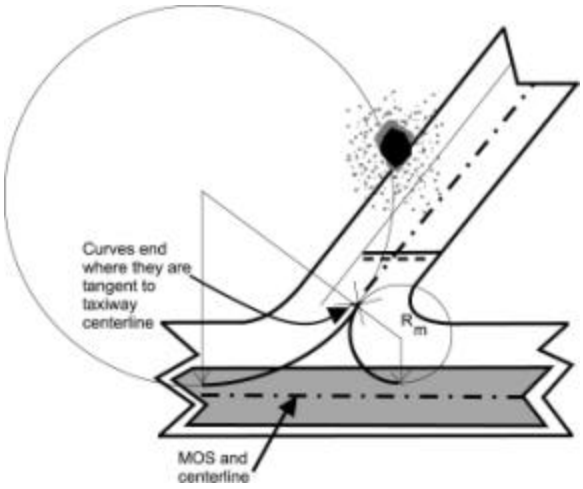
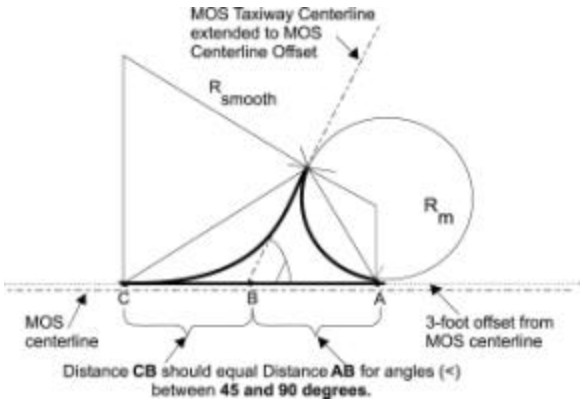


Figure 13. Typical Layout Measures for Taxiway Stripes at an Acute Angle Taxiway.



For CB distances that are excessive or would cause the edge of the taxiway to run off the full strength pavement (figure 14), use Point B as the basis for design. For the two centerlines meeting at Point B, cut an arc tangent to the two centerlines using a radius equal to $\mathbf{R_m}$.

There are circumstances that may dictate different types of curves. This may occur when a crater obstructs the lead-on area to the taxiway or where severely acute angles make Point B too great a distance to fit the MAOS. When this is the case, then adjoining curves could be necessary. Determine a point on the minimum radius arc between where a 45-degree to 90-degree turn (figure 15) would hit the arc and start the tangent to the curve at that point using a radius equal to or greater than $\mathbf{R_m}$. As with all workarounds, clear them through the RRR Team Chief and DCC up through the SRC and the Wing Operations Center (WOC).

Figure 14. Workaround Layouts for Excessive Length Arc.

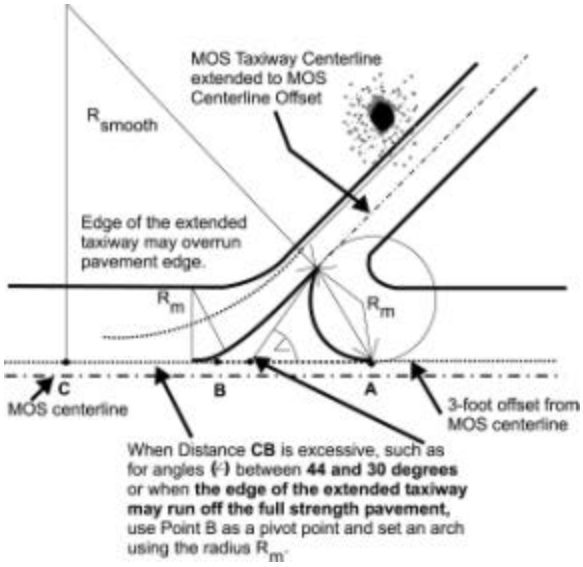
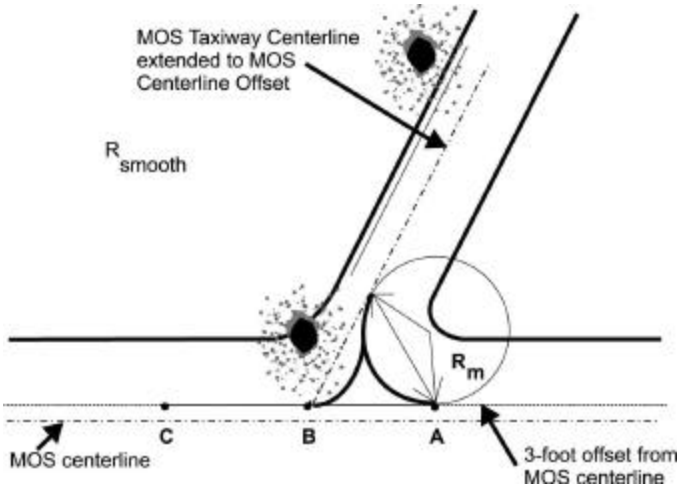


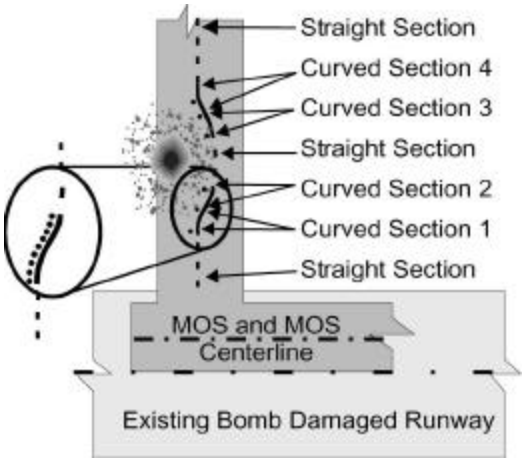
Figure 15. Workaround Layout for Taxiway Stripe at Restricted Locations.



Layout for Taxiway Changes in Direction. The Layout/Marking Crew lays out the taxiway centerline for changes of direction to avoid unrepaired craters or spall fields. Figure 16 depicts how to lay out a taxi line stripe around a damaged section of taxiway. The Layout/Marking Crew places cones at changes of direction around the damage. There is one cone each at the beginning and end of a curved section. Ideally three evenly spaced cones are place between the beginning and end cones, but this can vary based on the length of the curve and radius of the curve. The recommended practice is to separate each change in direction of curve by 25 feet. For some situations this may not be possible, such as when the length of the area is restricted to a short length. If the length of the offset is short, but the offset distance itself around the damaged area allows, the changes of direction can be made more or less continuous when laid out with large radius arcs. In this case, one cone may be used to mark the coinciding beginning and end points for two curved

sections. To provide proper alignment for the Paint Striper or Hand Wand, offset the cones to the left from the exact taxiway stripe (in the direction of travel of the paint striper). Determine the required offset with the Paint Striping Crew. As with many tight arcs, the Paint Striping Crew will normally use the Hand Wand for the arc sections. When unable to coordinate ahead of time, mark directly on the pavement the exact centerline locations for the points of the curve by using marker paint or Keel. This will allow the Paint Striping Crew to choose the method for painting and place cones for offsets as required.

Figure 16. Cone Layout around Taxiway Damage.



INSTALLATION

The following checklists provide detailed instructions for use of the MAOSMS. Checklist 3 is a general-purpose pre-attack checklist. The post-attack procedures in Checklists 4 to 6 should be followed after completing Checklist 1. Post-attack procedures for the Layout/Marking Crew are listed in Checklists 4 and 5 and for the Paint Striping Crew in Checklist 6. Checklist 7 provides information on system recovery after use. When an asterisk (*) follows a major heading or step in the checklist, there is additional specific information for that heading/step provided after the checklist.

Pre-Attack Efforts.

Checklist 3. General Purpose Pre-Attack Checklist.

Procedure	Actions
____ 1. Vehicles and supplies	____1) Identify and locate the following from Supply, Transportation, and CE resources: ____ a) Two vehicles or a vehicle and utility trailer, ____ b) Paint striping equipment, ____ c) Paint supplies and glass beads, and ____ d) Edge markers and vertical sign type markers. ____2) Obtain sandbags and fill; fill the sandbags (44 minimum for a bi-directional 10,000-foot MOS).
____ 2. Prepositioning equipment and supplies	____1) Identify with the EALS personnel several possible locations (at both ends and the middle of the runway) that could be used for locating the EALS generator during operations supporting a 5,000-foot MOS. ____2) Identify with DCC locations for dispersal of equipment. ____3) Pull and prepositioning the supplies and equipment (see Tables 1 and 2). Order additional supplies as required. Minimum quantities are: ____ a) Traffic cones (68 for 5,000-foot MOS and 93 for 10,000-foot MOS). ____ b) Edge and Threshold markers (88 for a 5,000-foot MOS and 138 for a 10,000-foot MOS). ____ c) Folding upright marker stands and base units (from 5

Procedure	Actions
	each for a 5,000-foot unidirectional MOS with one MAAS up to 22 each for a 10,000-foot bi-directional MOS with two MAAS).
____ 3. Ready upright markers	____1) At the prepositioning location, unpack the AGM and DTG markers from storage in their bags. ____2) Attach signfaces to crossbraces (Attachment 1) ____ a) Spread signface face down on a flat surface. ____ b) Position crossbrace perpendicular over the signface such that the crossbrace decal "TOP" is facing up. Ensure that the crossbrace tip without a rubber cap is located at the bottom of the signface. ____ c) Fold the 1/2-inch straps over the tip of the vertical rod of the crossbrace and the bottom and two interior straps on the vertical rod. Do not fasten the side straps on the horizontal rod. ____ d) Turn horizontal crossbrace to vertical position and roll signface up around the crossbrace. Secure with the long strap.
____ 4. Ready/Load edge markers	____1) At the prepositioning location(s) remove enough edge markers from their storage containers for a MOS. **The SRC should pre-designate the minimum size of the MOS (i.e., a 50- by 5,000-foot MOS or other size) used for planning.** Leave the remaining markers in storage and save the materials for repacking. ____2) Load the marker bases and "V" tops onto the truck or utility (flatbed) trailer. ____ a) The bases and "V" tops should be stacked separately and not preassembled. Secure the "V" tops to prevent blowing off the vehicles during transport. ____ b) Arrange the stacks to allow easy-reach offloading from the vehicle. It will depend on the height of the vehicle and sides whether the markers can be more quickly offloaded over the sides or the end of the vehicle.
____ 5. Ready paint and bead supplies	____1) Determine the basic quantities of paint and beads required for the pre-designated MOS size. ____2) Preposition the paint and beads as necessary based on MOS size and expected usage. ____3) Thoroughly mix the paint that will be used for the MOS. ____ a) Lay the paint drums on their sides and roll them to mix and agitate the paint. ____ b) Use extreme caution, as the paint drums are very

Procedure	Actions
	heavy. ____ c) Avoid puncturing or denting the drums while handling and mixing.
____ 6. Ready Paint Striper	____1) Service and prepare paint striper in accordance with TO 36C35-7-1. ____2) Install the appropriate paint and bead tips. Calibrate for 6 to 8 mil wet film thickness. Actual thickness may vary based on viscosity of paint, surface temperature and moisture, temperature, etc. * ____3) If the skip-controller has not been calibrated, then calibrate the unit for a 50-foot on/50-foot off spacing at 3-MPH speed. ____4) Calibrate the bead delay timer. ____5) Obtain or mix the cleaning solution/solvent. Flush the system as required for the paint types and to check the system. ____6) Determine the offset that can be used for painting the centerlines. If the normal 2-foot cone offset or exact centerline mark points can not be used, then notify the Layout Crew. *

Additional Information for Checklist 3: The following additional information is provided for this specific step.

Step 6. 2): Various tips are available for the Paint Striper. If a 6-inch wide taxi stripe is to be painted, then a tip that paints a 6-inch wide line may be used instead of the standard tip that provides a 12-inch wide line. However, the standard 12-inch tip can be used in many cases to provide the 6-inch wide line by angling the spray tip, cutting back on the paint spray density, and/or lowering the nozzle. Choosing a tip depends on: the paint; the air, paint, and surface temperatures; moisture levels, and the viscosity of the paint. Consider these factors when setting up the paint guns.

Step 6. 6): The normal setup for the Paint Striper is to off set the centerline cones by 2 feet to the left. This is almost always possible because the vehicles and the trailer used for painting are standard utility vehicles. When you are deployed, you may find that the only vehicles available at the contingency location or bare base are not standard utility vehicles. If this is the case, then the bumpers, visual sight lines over/around the fenders, truck

cab height, and truck bed height and width (especially if the Paint Striping unit is demounted from the trailer and used in the truck bed) could affect the required offset distance. If the aiming pointer and gun carriage can not be adjusted to accommodated the normal 2-foot offsets, then the Paint Striping Crew leader **must notify** the Layout Crew leader to tell them to use a different offset for centerline cones. Likewise, if cones were not available, the Layout Crew would mark directly on the pavement the exact centerline. If the vehicle and Paint Striper could not be adjusted to operate directly over the centerline (i.e., without an offset), tell the Layout Crew leader what offset must be used.

Post-Attack Procedures for the Layout/Marking Crew.

Layout.

Checklist 4. Marking Crew Post-Attack Layout with Cones.

Procedure	Actions
____ 1. Vehicle Checkout and Employment	____1) Check to ensure that the vehicles and trailer(s) are still operable. ____2) Based on the damage to the runway and choice of MOS, determine if any changes need to be made to the distribution of marking resources on the vehicle(s)/trailer(s). ____3) Determine the best routes and crewmember use for laying out the cones.
____ 2. Threshold	____1) Based on the MOS identifier provided by the SRC/DCC, locate the MOS on the runway. ____2) Determine the exact centerline and corners of the Threshold. ____3) Place a mark on the pavement at each exact location. Place a cone on each mark. [NOTE: the centerline and two Threshold cones create a "T" pattern with the centerline.] * ____ a) When cones are available, move the MOS centerline cones two feet to the left of the exact centerline (to create an offset centerline for aligning the paint striper). * ____ b) If paint marking is being used in lieu of traffic cones, do not offset the centerline. ____ c) Measure down the centerline 400 feet and mark the pavement at the exact MOS centerline. Place a cone

Procedure	Actions
	two feet to the left of the mark. ____ d) One person at Threshold end centerline cone sights along the two offset cones and directs the placement of a cone at the 200-foot point. ____4) From the Threshold centerline cone, look back from the end of the runway where the approach zone will be laid out. Judge by approximation whether there will be enough clear zone area to allow layout of 1,400 feet of approach zone lighting. If not, notify the RRR Team Chief that the approach zone area(s) will require clearing of debris.
____ 3. Centerline	____1) Mark the centerline of the MOS. Establish a distance control method to ensure that the 200-foot spacing is accurate. * ____ a) Place cones at 200-foot intervals along the offset centerline. [The offset is normally 2 feet but may have to be adjusted by the Paint Striping Crew.] The cones are called the centerline cones. * ____ b) If paint markings are used in lieu of cones, then mark on the pavement for the exact centerline at 25-foot intervals. * ____2) Ensure that the correct alignment with the MOS centerline is maintained by checking the distance from the original runway centerline to the cone/mark for every fifth 200-foot MOS centerline station (i.e., every 1,000 feet). ____3) See Procedure for "Craters" if there is damage on the MOS.
____ 4. Edge Reference	____1) Establish left edge reference marks from the Threshold to station 400. ____ a) At the 400-foot point, place an alignment cone on the left edge of the MOS. ____ b) One person at Threshold end centerline cone sights along the two offset cones and directs the placement of a cone at the 200-foot point. ____2) This is done at both ends. ____3) Consider placing edge reference cones on the right edge to allow completion of one end before moving to the other end. *
____ 5. PAPI	____1) Locate the inside PAPI unit by placing two stacked cones on the left side of the MOS 50 feet from the edge of the MOS and 950 feet down from the MOS Threshold. ____2) Adjust this PAPI distance as required based on variations in elevation and as necessary to avoid conflicts with other systems and pavement features. ____3) Site the outside PAPI unit by placing a single cone 20

Procedure	Actions
	feet outboard of the first cone.
____ 6. MAAS (AGM)	____1) Locate the position for the MAAS based on coordinates provided by the SRC/DCC. ____2) Place a cone at both edges of the MOS where the MAAS is to be located. ____3) Place a second cone 3 feet outboard of the first cone on each side.
____ 7. Craters	____1) At crater repairs, mark both sides of the crater repair with cones. ____2) Set up a "T" zone at least 100 feet from the edge of the crater. [NOTE: A"T" zone duplicates the "T" pattern on both sides of the crater.] * ____3) Maintain the 200-foot spacing of centerline cones through the crater repair area. *
____ 8. Taxiway Stripe(s)	____1) Taxiway entrance. Place three traffic cones next to each other in a triangle at the entrance to a taxiway. Two of the cones are placed on the edge of the MOS and the third cone is located where the taxiway centerline intersects the MOS. ____2) Taxiway stripe change of direction around unrepaired damage. ____ a) Place a mark at the start and end of each segment of the curve. ____ b) In lieu of cones, use marking paint or Keel to mark the exact location of each segment and at least the middle of the curve segment. ____ c) If cones are used then determine with the Marking Crew the required offset to the left of the intended centerline. This distance will be based on the method of marking (i.e., Hand Wand or Paint Striper). *
____ 9. Holding Position(s)	____1) Determine the locations of the taxiway holding position lines. The lines are normally sited 100 feet from the edge of the MOS. * ____2) Place two stacked cones on each end of the taxiway holding lines (for each taxiway). The holding lines are parallel to the MOS surface.
____ 10. Approach Zone *	____1) Sighting back along the centerline cones, place 7 cones at 200-foot separations outboard of the Threshold. ____2) Move the cones over 2 feet (or as required) to the right such that they align with the exact MOS centerline.
____ 11. EALS Generator Location	____1) Identify location for EALS generator/regulator based on selected MOS and Pre-Attack siting. ____ a) Adjust the siting based on damage to the pre-sited

Procedure	Actions
	area, MOS length, and having a level and flat area large enough within 25 feet of the generator to allow placement of the fuel supply. ____ b) Place a single cone 50 to 200 feet from the MOS near the midpoint of the MOS to identify this generator/regulator location. ____ c) Notify RRR Team Chief and EOD of the location and access routes to allow them to include in safing and clearing efforts. ____2) Coordinate with EALS team on their installation timeframes and priorities.
____ 12. EALS priority: DTG Markers and AGM	____1) When the EALS must be deployed prior to placement of markers, check with EOD to ensure the areas along the side(s) of the MOS have been safed. ____2) Place a single cone for each DTG marker location on the right side of MOS (for unidirectional operation) or on both sides (for bi-directional operation). See Table 3 Emergency Criteria and Limitations regarding placement. ____3) At each AGM location place a single cone on the right side of MOS (for unidirectional operation) or on both sides (for bi-directional operation). See Table 3 Emergency Criteria and Limitations regarding placement.
____ 13. MOS Runway Immediate Launch	____1) Obtain the list of minimum markings and coordinates for the end points. ____2) Determine the resources required to provide the minimum marking required by SRC. ____3) Locate both ends of the MOS and layout the exact centerlines and corners with cones. ____4) Layout edge reference cones for first 400 feet on both sides of the MOS. ____5) Use visual alignment and tape measure to layout any other specific minimum markings for the MOS. See Checklist 5 for detailed steps for specific markings, as applicable.

Additional Information for Checklist 4: The following additional information is provided for these specific steps.

Step 2. 3): When placing the exact centerline cones and the edge of Threshold cones, it is suggested that you use a bright marker (such as pavement spray paint or marking Keel) to mark the locations. Mark a small

(about 6-inch high) "**X**" on the pavement under the exact centerline cones before they are moved. Mark under each Threshold corner cone with a small "90º angle" mark (i.e., ⌜ , ⌟ , ⌜ , and ⌟) that points toward the Threshold centerline cone and along the edge of the MOS. This will ensure that when/if the cones are knocked over during any initial runway recovery efforts, the reference points can be quickly found and reestablished. Marking also helps the Paint Striping Crew to confirm that they are marking on the correct side of the marked centerline. Without a mark, this can be much harder to determine at night, in chemical gear, and with reduced visibility caused by smoke from bomb damaged facilities.

Step 3. 1): If there is a runway identification system that is still intact after the attack, then station marker posts may be used as a guide for laying out the 200-foot distances. If not available, then establish a pattern to quickly measure the distances using the measuring tape and pacing steps. Pacing steps may not be possible if chemical gear is worn.

Step 3. 1) a): See Pre-Attack Checklist 3 Step 6. 6) about adjusted offsets.

Step 3. 1) b): When paint markings are used in lieu of cones, marking the pavement at 25-foot intervals is required to allow the Paint Striping Crew to maintain sighting alignment. Develop a marking technique to identify the 100-foot and 200-foot station points. One suggested method is use 6-inch high letters for:

Intermediate 25-foot markers **X** ,

The 100-foot station markers $\underline{\mathbf{X}}_{\mathbf{1}}$, and

The 200-foot station markers $\underline{\mathbf{X}}_{\mathbf{2}}$.

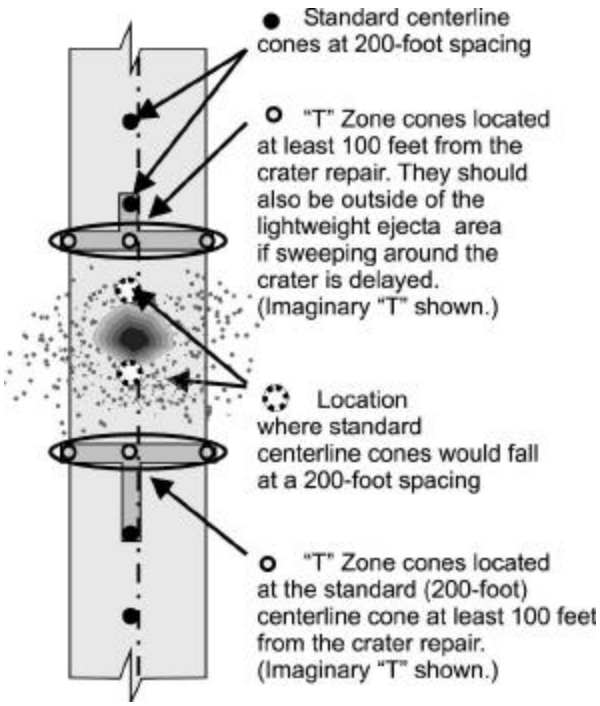
The "X" provides an exact centerline location and the paint machine will obliterate the marks while painting. [See Pre-Attack Checklist 3 Step 6. 6)

about adjusted offsets.] The marks can be seen from the edge of the MOS to allow placement of the markers at the 200-foot stations.

Step 4. 3): If there are crater repairs within or along the MOS, the edge could be obstructed or the normal marking procedures could be disrupted. When the MOS is long, it may be difficult to use only the left side alignment cones at opposite ends of the MOS. This is also the case when the MOS is partially obscured by smoke or darkness. Consider also using right side alignment cones at the 200- and 400-foot stations instead of just placing left side alignment cones.

Steps 7. 2) and **7. 3):** The "T" zone should be located at the closest 200-foot interval spacing marker that is at least 100 feet from the edge of the crater. See example of a typical layout in figure 17. Avoid setting the "T" zone within a large debris field that will not be cleared prior to painting. Maintain the 200-foot spacing through the area of repair.

Figure 17. Typical "T" Zone Layout at a Crater.



Step 8. 2) c): The offset for painting will almost always be to the left of the required taxiway centerline stripe to prevent crossing over fresh centerline stripes or other segments of the taxiway stripe. The Paint Striper is usually set up for the left gun of the gun carriage. The offset distance for painting the taxiway centerline stripe will depend on whether the Paint Striper or the Hand Wand is used. [Check with the Paint Striping Crew leader to determine the offsets required.] Normally if the tums are tight or close together, the Hand Wand must be used. If in doubt about the offset amount, then make a small centerline mark "$\overset{C}{L}$ " on the pavement (using a bright marker) to designate

where the actual taxiway stripe is required. The Painting Crew will see this and adjust their offset as necessary.

Step 9. 1): Adjustment in the distance from the edge of the MOS may be required under several circumstances.

> If the taxiway is located at an acute angle of 45 degrees or less **and** emergency cargo aircraft (i.e., the C-130 and/or C-17) will use the MOS, the taxiway holding line may have to be set back farther. Locate the taxiway holding line far enough back to prevent any portion of the wing from extending closer than 100 feet from the edge of the MOS. A distance of 125 feet from the edge of the MOS will prevent intrusion.
>
> If the taxiway is located at an acute angle with the MOS **and** a large radius turn is required, the taxiway holding line may have to be set back farther than 100 feet from the edge of the MOS. Locate the holding line at least 10 feet outboard from where the end of the large radius curve intersects with the centerline of the MOS taxiway.

Procedure 10: Timing for the layout for the Approach Lighting cones depends on when EOD can assess and safe the areas at the ends of the MOS. Due to the timelines for EOD clearing efforts, **you probably will not be able to place the cones in the approach zone area until after all the cones have been placed for the MOS and markers are being laid out.** The steps provided are based on laying out the system at the end of the layout process.

Marking.

Checklist 5 normally occurs together as part of one operation, usually along with the Layout steps. The procedures can vary based on the situation, such as when one end of the MOS has UXO safing and clearing underway or the MOS has several craters being repaired in an area with a lot of debris. Figure 18 depicts a typical layout for the MAOSMS markers.

Checklist 5. Marking Crew Post-Attack Placing Markers.

Procedure	Actions
____ 1. Responding to Airfield	____1) Check to ensure debris is being removed from the areas where markers are required. ____2) Check to ensure that the same areas have been assessed and safed by EOD. ____3) Make a final determination of crewmembers and allocation of vehicles for the routes.
____ 2. Threshold	____1) Deposit 10 edge marker bases and tops on each side of the Threshold. ____2) Have one person place and assemble the Threshold markers while the other crewmembers proceed. ____3) Place the base of the first marker away from the edge of the MOS at the predetermined setback distance. ____4) Set the remaining 9 bases in a straight line out from the MOS. [Providing a 4- to 6-inch separation between each base will allow enough room for the installation of the tops without damaging the signs.] ____5) Attach the "V" tops to each base. ____6) Repeat on the other side of the MOS. ____7) The Threshold installation member aligns by sight the initial placement of edge markers by the other crewmembers and then rejoins the crew after installing the 20 markers on the one end. ____8) Repeat when you get to the other end of the MOS.
____ 3. Edge Markers	____1) Proceed from the Threshold markers along one side of the MOS and offload one edge marker base and top opposite the 200-foot station cone or mark on the MOS centerline. ____ a) Do not place an edge marker for two stations past a unidirectional MAAS. ____ b) Do not place an edge marker for two stations before and after a bi-directional MAAS. ____ c) Check on the MAAS runout configuration. If the MAAS is configured for a 1,200-foot runout, a third edge marker may have to be removed if within approximately 550 feet of the MAAS and the MOS is narrow. ____2) Place the base of the markers away from the edge of the MOS at the predetermined setback distance. This will be in line with the inside Threshold marker at between 4 to 10 feet from the edge of the MOS. ____3) Assemble each edge marker base by aligning the edges

Procedure	Actions
	of the hook and loop fasteners on the tops and bases and pressing them together firmly. ____4) Continue down the MOS edge to install markers at every 200-foot station. The first two markers on the left can be installed by measuring off the left edge reference cones. The remaining edge markers are aligned by line of sight – the person installing the Threshold markers can assist with alignment until rejoining the crew.
____ 4. DTG Markers	____1) Based on the length of the MOS, determine the locations to receive DTG markers on the right side of the MOS. If the MOS is bi-directional, install appropriate DTG markers on the MOS side you are working. * ____2) Locate and place the first DTG marker position as you come to the appropriate 200-foot station. * The setback distance from the runway is normally 25 feet -- see Table 3 Emergency Criteria and Limitations regarding placement if there are conflicts. ____3) Assemble and place the marker and sandbag anchoring (see Attachment 2). ____4) Proceed to the other 1,000-foot stations and install the DTG markers.
____ 5. MAAS (AGM)	____1) Locate and place the first AGM on the right side facing toward the primary Operational Threshold. ____2) For bi-directional use, place a second AGM on the left side of MOS facing away from the primary Operational Threshold. ____3) Locate and place the marker. The normal setback distance from the runway is either 25 or 35 feet back form the edge of the runway, based on placement of the DTG markers and MAAS. See Table 3 Emergency Criteria and Limitations regarding placement if there are conflicts. ____4) If a second MAAS barrier is deployed and used, repeat the above steps and try to place signs at the same setback distance, if possible.

Additional Information for Checklist 5: The following additional information is provided for these specific steps.

Step 4. 1): DTG markers are installed on the right side of the MOS. If the MOS is bi-directional, then there will also be a DTG marker on the Marking Crew's left side as it proceeds from the Operational Threshold toward the departure end of the MOS. The left and right DTG markers are placed directly across from each other at the designated stations. The Marking Crew's placement of DTG markers as they proceed on their left side of the MOS must ensure that the signs face in the opposite direction from those on their right side of the MOS.

Step 4. 2): When the MOS is an even increment of 1,000 feet (example: 4,000-, 5,000-, and 6,000-foot long), then the DTG markers can be placed at the 1,000-foot intervals. If the MOS is not an even increment of 1,000 feet (example: 4,500-, 5,300-, 6,400-foot long), then the DTG markers must be adjusted.

Table 4 presents the adjustment procedure and an example. The example is also depicted in figure 19.

Figure 18. Typical Placement of MAOSMS Markers.

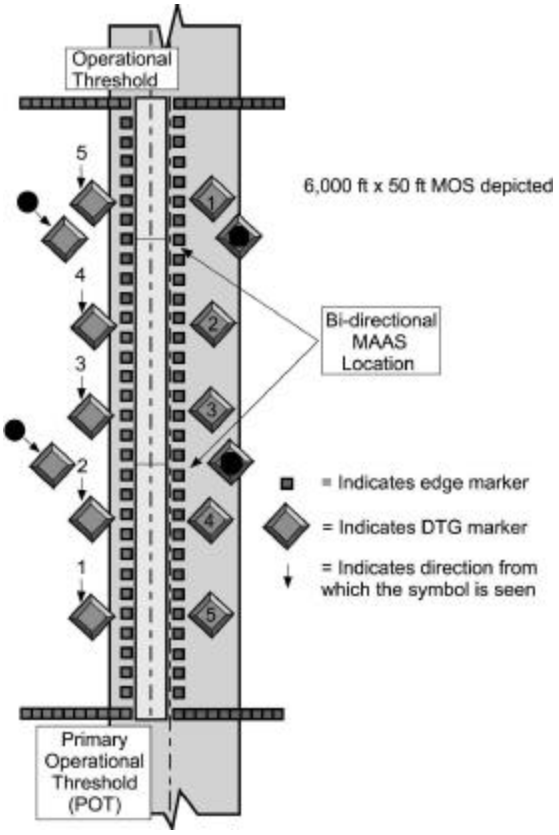
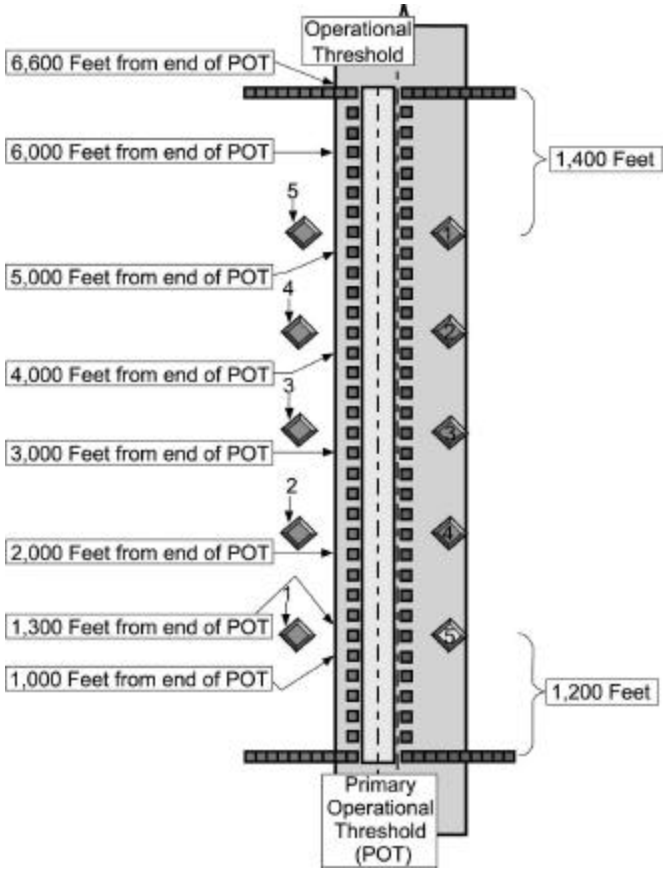


Table 4. Adjusting DTG Marker Distances.

Adjusting Procedure	Example
Take the distance that is not a multiple of 1,000 and divide in half.	• A MOS is 6,600 feet long and is bi-directional. • Divide the 600 feet by 2. The result is 300 feet.
Add the result to the 1,000 feet at each end of the threshold.	• Add the result to 1,000 feet. • The sum is 1,300 feet.
If this distance would fall between the 200-foot edge markers, then align the first DTG marker with the closest edge marker toward the Threshold.	• The distance 1,300 feet from the Operational Threshold would fall between the 1,200- and 1,400-foot edge markers. • Move the DTG marker on the right side to the edge marker closest to the Operational Threshold. This would be the 1,200-foot edge marker. [Adjust this way to allow use of the EALS lighting system standard 200-foot electrical chords.]
If the MOS is bi-directional, then align the last DTG marker for the other direction with the first DTG marker that is toward the Threshold that will be used most often (i.e., the primary Operational Threshold).	• Place a "**5**" DTG marker at this location on the right side of the MOS **facing toward** the primary Operational Threshold. • Place a "**1**" DTG marker directly opposite on the left side of the MOS **facing away from** the primary Operational Threshold. • Adjust the distances such that the (primary) departure end receives the additional distance if the DTG markers were to fall between the edge markers.

Figure 19. Example for Adjusting DTG Marker Distances.



Post-Attack Procedures for the Paint Striping Crew.

Warning. Do not place hands under an operating paint or bead gun. High pressure may cause paint or beads to be injected under skin and cause serious personal injury.

Caution. The Paint Striping set guns, tanks, filters, and lines must be completely flushed and cleaned with water before and after each use to prevent clogging or erratic performance.

Caution. Beads must be kept dry to work properly. After painting, all beads must be removed from bead tank, lines, and guns to prevent clogging.

Checklist 6. Paint Striping Crew Post-Attack Actions.

Procedure	Actions
____1) Vehicle Checkout and Employment	____1) Check to ensure that the vehicle and trailer are still operable. ____2) Check installation of system components (i.e., tanks, guns, filters, and lines) and flush the systems. ____3) Based on the damage and repair and marking efforts, determine the order of painting. ____ a) Coordinate with the RRR Team Chief and ensure that the centerline receives passes with sweeper and grader prior to striping. ____ b) Normal procedure is to load and paint with: ____ (1) White paint for the airfield markings, ____ (2) Black paint to obliterate conflicting airfield markings, and ____ (3) Yellow paint on the access taxiway(s) and holding positions. ____ c) Make a final determination on the amount of paint and beads that will be required (based on a travel speed of 3 MPH). ____4) Agitate and load paint into the tanks. * ____5) Load beads into the tank. ____6) If operating on the trailer, load solvent for flushing and an additional paint drum, if required.

Procedure	Actions
____2) MOS Striping with White Paint	____1) Threshold: ____ a) Paint the 30- to 36-inch wide Operational Threshold "T" line using the traffic cones or pavement marks (if used in lieu of cones) as a guide. The "T" line is the full width of the MOS. ____ b) If it is possible to start painting the centerline stripe first and come back to paint the initial threshold "T" line, this will avoid tracking paint down the MOS. ____ c) When finished painting the centerline stripe, paint the threshold "T" line at the other end of the MOS. ____2) Centerline: ____ a) Set up the paint striper to paint the 30- to 36-inch wide centerline on the true centerline. Use the traffic cones as the left edge guide unless pavement centerline marks are used in lieu of cones. ____ b) Paint a stripe starting at the Threshold "T" line. The stripe must be at least 50 feet long. ____ c) If the length of the MOS is not an even increment of 100, then for a: ____ (1) Unidirectional MOS, add the distance that is not divisible by 100 to the length of the last stripe connecting with the departure end "T". ____ (2) Bi-directional MOS where the difference in length is not divisible by 100, add half the difference to each end of the MOS. The first and last stripe connecting to the Operational Threshold "T"s will be 50 feet plus one-half the difference. ____3) Flush and clean out the Paint Striper system. ____ a) Load with paint and glass beads (if required) for the next painting operation. ____ b) Check to ensure that the nozzle tips to be used for the next operation are properly adjusted or need to be changed.
____3) Obliteration	____1) Coordinate with the DCC regarding which markings must be obliterated within, adjacent to, or near the MOS and MAOS taxiways. * ____2) Black out runway marking that would cause confusion. DO NOT USE GLASS BEADS. ____3) If a repair area is encountered, by pass the area and continue black out procedures on the other side of the repair. Black out the repair area when/if time permits, but check with the RRR Team Chief before going back.

Procedure	Actions
	____4) Black out access taxiway markings for unusable taxiways and lines. See also Unusable Access Taxiway Marking below. ____ a) Lines that are within 50 feet of the MOS. ____ b) Existing taxiway marks within the first 50 feet of the unusable portion of the taxiway. ____ c) Begin blackout at a point where aircraft can change direction of taxi or stop and turn 180 degrees within the available taxiway width. This point should be provided by the DCC. ____5) Flush and clean out the system. ____ a) Load with paint and glass beads (if required) for the next painting operation. ____ b) Check to ensure that the nozzle tips used for the next operation are properly adjusted or need to be changed.
____4) Taxiway Lines	____1) Taxi Stripe Set-Up: ____ a) Set up guns on the Paint Striper and the Hand Wand to provide 6-inch wide stripes. ____ b) Determine the offset required for using the Paint Striper and/or the Hand Wand. ____ c) Reload Paint Striper with yellow paint and glass beads. ____ d) Layout of short radius, simple arcs. If the radius of turn is a simple, short radius arc, then use the tape to find the start and stop point of the arc. ____ (1) Hold one end of the tape at the center location of the arc. ____ (2) Turn the radius and place a cone or mark on the pavement at the start and end of the line and at three equally spaced points around the arc between the first two cones/marks. ____ e) Layout of a more complicated or longer radius arc. * ____ (1) Mark on the pavement for the taxiway lead-on and lead-out points for the taxiway stripe. At least 5 locations on the arc will be required to layout most arcs. Marker paint may be used in lieu of the cones, especially if the area is to be trafficked and the cones may be disturbed. ____ (2) Place a cone/mark at the start for the nose-wheel guideline at the start of the arc 3 feet from the MOS centerline. If the MOS is bi-directional or the taxiway accesses the MOS in both directions,

Procedure	Actions
	two arcs may be required for the taxiway. ____ (3) Place a cone/mark at the termination location for the arc(s) where they meet the taxiway centerline or common intersecting point. ____ (4) Lay out the middle section of the arc(s) by placing one cone/mark in the middle and two cones/marks midpoint between the middle and end cones/marks. ____ f) Layout of lead-on/-off straight sections. ____ (1) Place a cone/mark every 50 feet for the 200-foot distance for the nose-wheel guideline stripe on the MOS from the end of the arc. ____ (2) Place a cone/mark at the taxiway centerline 5 feet from the taxiway holding position and a second cone/mark midpoint between the holding position cone/mark and the cone/mark at the end of the arc(s). ____ g) For all cones, offset the cones the required amount to the left of the centerline of the actual paint striping mark. [The Paint Striper should travel to the right of the reference marks and make right hand sweeping turns in order to stay off the fresh centerline paint.] ____2) Painting Taxi Stripes. Paint according to the set up for reference cones or marks. If marks were placed on the pavement in lieu of cones then set up the Paint Striper or Hand Wand directly over the marks. If cones were used, then set up the Paint Striper or Hand Wand based on the required offsets. ____ a) Paint a continuous 6-inch wide taxiway stripe. ____ b) The stripe should run 200 feet parallel to the centerline of the MOS with a 3-foot offset from the centerline on the side of the taxiway. ____ c) The taxiway turn is then painted as an arc to intersect the taxiway centerline. It becomes the taxiway centerline at the end of the arc. ____ d) The taxiway centerline is painted to a point 5 feet short of the taxiway holding line. ____ e) If there is a curve on the other side of the taxiway centerline to another 3-foot offset at the MOS centerline, then set up at the point of tangency with the centerline and the first arc. ____ f) Paint this stripe along the reference cones or marks to a point 200 feet down the MOS centerline.

Procedure	Actions
	____ g) If the Hand Wand was used in lieu of the Paint Striper, then glass beads will have to be spread manually. *
	____3) Holding Lines:
	____ a) Between the double stacked cones designating the taxiway holding line, paint two 6-inch wide lines with a 6-inch space between the lines. Paint the lines the full width of the MAOS taxiway.
	____ b) The line closest to the MOS is a dashed line using a 3-foot painted section separated by a 3-foot skip.
	____ c) The line away from the MOS is a solid stripe.
	____4) Unusable Access Taxiway Marking:
	____ a) Place a 90-degree Cross " ✚ " on the centerline of the blacked out portion of the taxiway marks. Each leg of the Cross is 1 foot wide and 6 feet long (i.e., a 13-foot by 13-foot Cross).
	____ b) Orient the Cross at a 45-degree angle to the centerline of the taxiway.
	____ c) Paint the Cross 50 feet from the edge of the MOS. This distance may vary based on requirements for obliteration of unusable taxiways.
____5) Manual Painting	____1) If the Paint Striper fails, manual painting will be required. Contact the RRR Team Chief to advise on the status of painting and to determine painting priorities and requirements.
	____2) Obtain 2-gallon paint sprayers from the RRR trailer.
	____3) Fill the paint sprayers with required color of paint for striping and blackout.
	____4) Spray the MOS centerline at least 6-inches wide using the paint sprayers. A 6-inch centerline can be used for takeoff.
	____5) Widen the line to the required (minimum of 30 inches) width for landing when time permits.
	____6) Use paint rollers to spread the paint more evenly. The rollers can be used to widen the lines and make them more uniform as well as to spread out the paint for faster drying.
	____7) If the paint spreader is out of action during the time of recovery, then hand spread glass beads while painting. *

Additional Information for Checklist 6: The following additional information is provided for these specific steps.

Step 1. 4): If paint has previously been stored in the tank for short periods of time, then scoop off any skin that may have formed on the top of the paint and then stir/agitate as required. Some paints can be stored for up to 3 weeks in the paint tanks if a 1-inch layer of thinner is floated on top of the paint. Scoop out the thinner prior to using the paint.

Step 3. 1): The blackout priorities vary based on the location of the MOS and the type of aircraft operations being conducted. Below are the areas that normally must be blacked out to prevent conflicts with MOS marking or confusion and distraction for the pilots. Table 5 provides a prioritized list of obliteration priorities, some of which are depicted in figure 20 for an example MOS located near a runway's Operational Threshold. See also Attachment 3 for nomenclature designations for standard airfield marking. In some cases, when time is available during initial runway layout, blackout may be accomplished prior to other painting. If MOS markers and EALS components will be placed over or near areas to be obliterated, then consider blacking out these areas earlier to avoid conflicts with placement of the markers and EALS components.

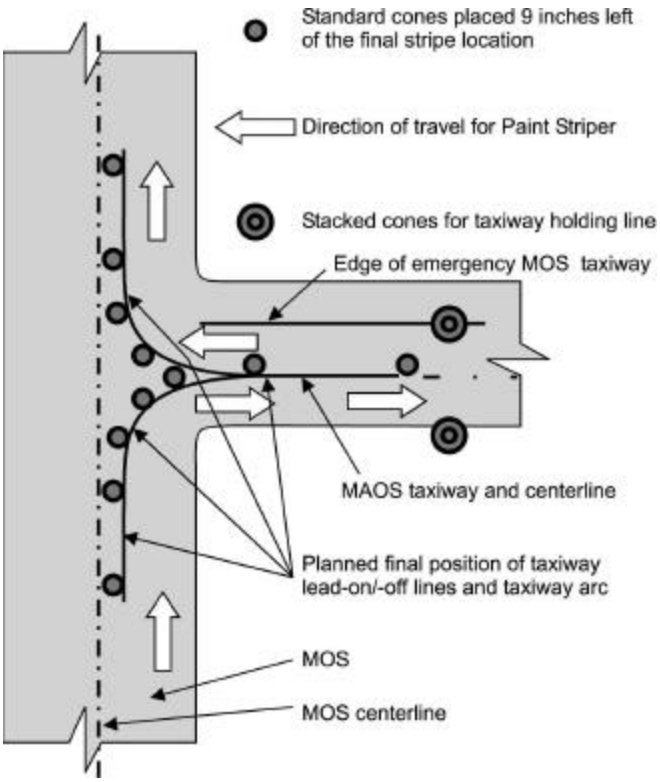
Table 5. Normal Blackout Priorities.

Markings on the MOS	Marking in the Approach Zone
1. Threshold Marking	1. Threshold Marking
2. Designation Marking	2. Designation Marking
3. Centerline Marking	3. Centerline Marking
4. Aircraft Arresting System Location Markings (if the system is out of service)	4. Aircraft Arresting System Location Markings
5. Unserviceable Taxiway Lead In/Out Lines	5. Touchdown Zone Markings
6. Touchdown Zone Markings	6. Fixed Distance Markings
7. Fixed Distance Markings	

Figure 20. Example MOS Obliteration Requirements.

Step 4. 1) e): Placing cones or marks for the layout of typical taxiway lines is shown in figure 21. Also follow previous section for layout: Taxiway Paint Striping Layout.

Figure 21. Typical Paint Striper Direction-of-Travel and Layout for Taxiway Stripes



Steps 4. 2) g) and **5. 7):** One suggested expedient method to spread the glass beads is to load the glass beads into sandbags. Numerous bags can be preloaded and stacked for use. Punch several small holes on one side at the end of the bag. The holes should be just large enough to allow the glass beads to flow from the bags when the bags are held up and lightly shaken. Immediately after the paint has been hand sprayed and rolled out, shake the

beads over the fresh paint. The paint should be of sufficient thickness after rolling to allow the beads to be imbedded but not completely covered.

System Recovery. After the MOS has met its mission requirements, the MAOSMS must be recovered. Usually the whole system will be recovered at one time unless the airfield is to be upgraded for further use. If the airfield will become a contingency airfield, then some of the markers, the Paint Striping equipment, and the EALS will be required for further use. The DCC will direct the degree of recovery or redeployment and use. When directed to recover the system, follow the procedures of Checklist 7.

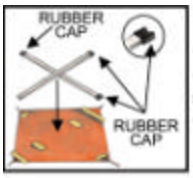
Checklist 7. MAOSMS Recovery.

Procedure	Actions
____ 1. Edge Markers	____1) Obtain a large utility truck or truck with a flatbed trailer and drive along the edge of the MOS. ____2) Separate edge marker tops from the bases. ____3) If the markers are clean and dry, then stack the units such that bases are stacked with bases and "V" tops are stacked on the other tops. ____4) If dirty or wet, then temporarily stack the units for transport to an area for cleaning. ____5) Offload the tops and bases and if necessary, wipe down with water and a cloth or soft bristle brush. ____6) Dry the tops and bases and repackage. Ensure that packaging includes an opaque cover for protection from ultraviolet light.
____ 2. DTG markers and AGMs	____1) Obtain a pickup truck (or use the same large utility truck or truck with a flatbed trailer used to pick up the edge markers). ____2) Pick up the DTG markers and AGMs. ____ a) Reverse the procedures of Attachment 2 to disassemble the upright stands ____ b) Reverse the procedures of Attachment 1 to disassemble the signfaces. ____3) Clean the flexible faces and all stand components with water and a cloth or soft bristle brush. Dry the components. ____4) Repackage markers if being placed back in storage.
____ 3. Paint Striping Set	____1) Bead tanks. ____ a) Remove all beads from the bead tanks. ____ (1) Scoop out the beads or ____ (2) Disconnect a bead gun hose and blow the beads

Procedure	Actions
	into a clean container under 10- to 15-PSI pressure. ____ b) Give each air solenoid a light shot of lubricating oil or WD-40 in the exhaust port and the small hole above the port. ____ c) Release pressure from the bead tank. ____2) Paint tanks. ____ a) Empty the paint tanks using low pressure. Ensure that if paint was temporarily stored in the tanks, that any paint skins are removed manually. ____ b) Remove the paint tips and soak and clean with solvent. ____ c) Flush the paint tanks with compatible solvent using no more than 500-PSI pressure. ____ d) Relieve the pressure in the system. ____3) Clean the high-pressure paint filters. ____4) Ensure that there is special pump lubricant (Lubrisolv) in the wet cup of the paint pump. ____5) Follow TO 36C35-7-1 to perform other required procedures for maintenance and preparing for storage. ____6) Wash entire Paint Striping set and store in a warm, dry place.

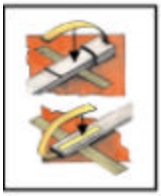
Michael E. Zettler, Lt General, USAF
DCS/Installations & Logistics

Attachment 1
STANDARD PRE-ATTACK SIGN FOLDING INSTRUCTIONS.



STEP 1

•Spread signface down on a flat surface.
•Position crossbrace perpendicular over the signface such that the crossbrace decal "TOP" is facing up.
•Ensure that the crossbrace tip without a rubber cap is located at the bottom of the signface



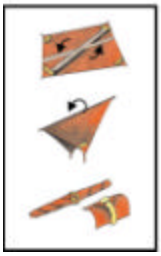
STEP 2

•Fold the ½-inch straps over the tip of the vertical rod of the crossbrace.

•Fasten the ½-inch bottom straps as shown.

STEP 3

•Fasten the two interior straps and the top strap on the vertical rod.



STEP 4

•Do not fasten the side straps on the horizontal rod.

•Turn horizontal crossbrace to vertical position.

•Roll the signface up around the crossbrace.
•Secure with the long strap.

Attachment 2
VERTICAL SIGN ASSEMBLY DIRECTIONS

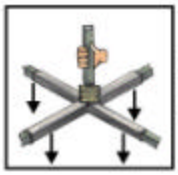
STEP 1

•Pull out the telescoping leg of each signholder until the detent button on the inner section of the leg automatically snaps into the matching hole on the outer section and locks into place in the fully extended position.

•Ensure that the legs are fully extended in order to prevent the signs from tipping over under high wind loads.

STEP 2

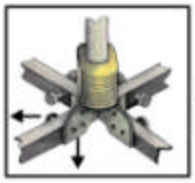
•Drop all 4 legs one at a time by pulling on the locking pin to release the legs.



STEP 3

•Grasp the holder upright and lift stand about a foot to allow the leg holders to fall into their locked position.

•Ensure that the center of the holder is 2 to 3 inches above the ground.



STEP 4

•If the sign is on uneven ground, individually adjust the position of the leg by pulling out the locking pin and positioning the leg at another hole.

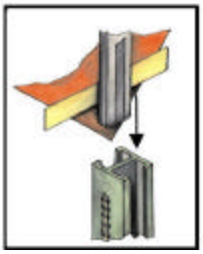
STEP 5

•Sign legends are printed on the corners of the previously rolled up signs.
•Select the signface with the required legend and unroll the sign.
•Turn crossbraces perpendicular to each other.

STEP 6

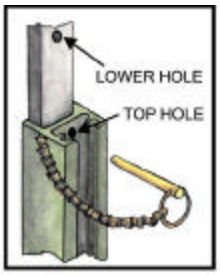
•Pull the sign's face taught and pull the 1/2-inch strap out and over the tip of the crossbrace.
•Fasten the strap to the crossbrace strip.

•Fasten the side straps together over the fastened strap.



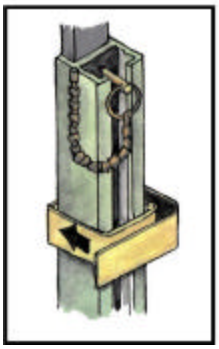
STEP 7

•Slide the bottom end of the vertical crossbrace into the channel upright on the stand.



STEP 8

- Slide the vertical brace into the upright channel until the top hole of the channel aligns with the lower hole of the crossbrace.
- Lock the signface into the sign base by inserting the hitch pin through the two holes.
- Ensure that the hitch pin is completely through both holes.



STEP 9

- Fasten the sign side straps around the upright channel of the base.

ATTACHMENT 3
SUPPORTING GRAPHICS FOR RUNWAY/MOS RELATED TERMS

The following figures are used to depict terms (for MOS operations) that are used throughout the handbook.

Figure A3.1. Terms Related to Unidirectional MOS.

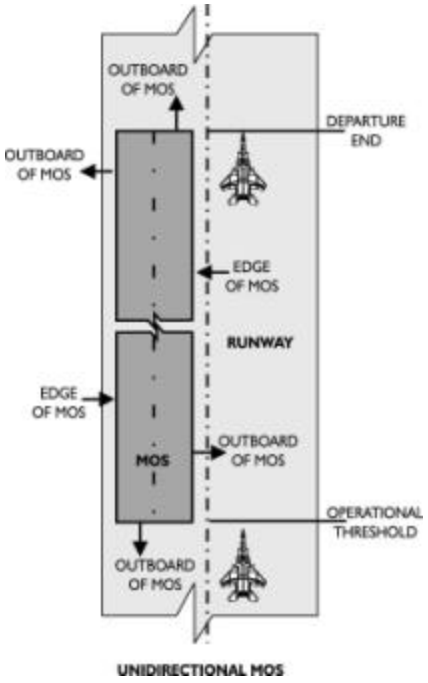


Figure A3.2. Terms Related to Bi-directional MOS.

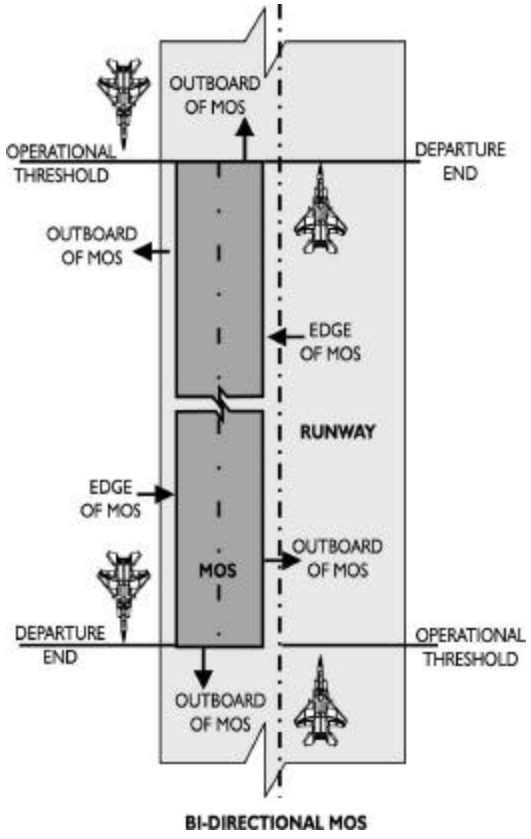
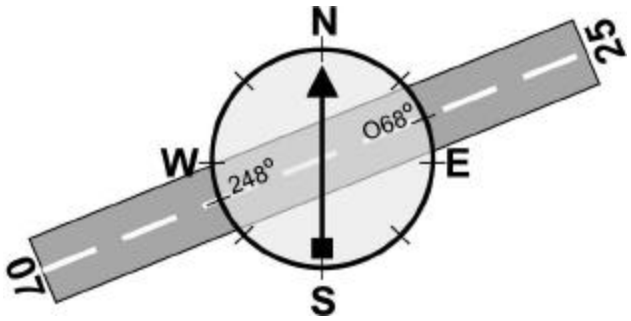


Figure A3.3. Orientation of Runway.



While there are various NATO, FAA, and Air Force standards for airfield marking, the deployment location may have adopted or used markings that vary from the standards. Figure A3.4 depicts the basic marking configuration for jet runways longer than 4,000 feet and relates to the categories listed in Table 5 for obliteration priorities.

Figure A3.4. Standard Airfield Marking Nomenclature.